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The Status (1960-1997) of Alewife and Blueback Herring Stocks in the Scotia-Fundy Area as Indicated by Catch-Effort Statistics

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Abstract

The status of alewife (Alosa pseudoharengus) and blueback herring (A. aestivalis) stocks in Scotia-Fundy area, based on trends in reported fisheries landings, licences issued, and catch-per-unit-of-effort, varied greatly within individual rivers and regionally. Alewives occur in more rivers and in higher proportion than do blueback herring. The largest catches of alewives occurred in the Saint John and Tusket rivers. High intraregional variability exists in the choice of gear type - set and drift gill nets, dip net, and trap net. Gill net fisheries are most active in the mouths of larger rivers, dip nets are most frequent near the mouths of small-to-moderately-large rivers, and trap nets are confined primarily to the inland waters of the large Saint John River. A change during the mid-1980s from the use of sales slips and Supplementary B catch estimate reports to the use of logbooks by individual fishermen and the unenforceable nature of the requirement for logbook use until 1993, when changes were made to the Fishery (General) Regulations, resulted in a substantial underestimate of true catches during this transition period. In recent years, reported landings have generally declined except in the Tusket River. Fishing effort has fluctuated greatly and catch-per-unit-effort declined before recovering slightly. Reduced fishing effort may be required to improve spawning escapements and ultimately to increase future catches in many rivers.

Résumé

Selon les tendances des débarquements déclarés, des permis délivrés et des prises par unité d'effort, l'état des stocks du gaspareau (*Alosa pseudoharengus*) et de l'alose d'été (*A. aestivalis*) dans la région de Scotia-Fundy a fortement varié tant à l'intérieur des cours d'eau qu'à l'échelle régionale. Le gaspareau est présent dans un plus grand nombre de cours d'eau et en proportions plus fortes que l'alose d'été. Les plus importantes prises de gaspareau ont eu lieu dans les rivières Saint-Jean et Tusket. Il existe une grande variabilité intra-régionale dans le choix des types d'engins : filets maillants fixes et dérivants, carrelets et filets-trappes. La pêche aux filets maillants est la plus pratiquée aux embouchures des grosses rivières; l'utilisation des carrelets est plus fréquente près des embouchures de cours d'eau de petite et de moyenne taille, tandis que celle des filets-trappes est généralement limitée aux eaux intérieures de la grande rivière Saint-Jean. Vers le milieu des années 1980, le passage de l'utilisation des bordereaux de vente et des rapports Supplémentaires B d'estimation des prises à la tenue de livres de bord par les pêcheurs, ainsi que la nature inapplicable de cette exigence jusqu'en 1993, lorsque des changements ont été apportés au Règlement de pêche (dispositions générales), ont amené à sous-estimer grandement le volume réel des prises au cours de cette période de transition. Ces dernières années, les débarquements déclarés ont généralement diminué, sauf ceux de la rivière Tusket. L'effort de pêche a fluctué de façon substantielle, et le nombre des prises par unité d'effort a d'abord baissé, puis s'est rétabli quelque peu. Une réduction de l'effort de pêche serait peut-être nécessaire pour assurer l'amélioration des échappées vers les frayères et, à plus long terme, une hausse des prises dans de nombreux cours d'eau.

Introduction

Alewives (Alosa pseudoharengus) and blueback herring (A. aestivalis), jointly and commonly termed gaspereau, river herring, or alewives, support important commercial fisheries in the former Scotia-Fundy Region, hereafter termed the Scotia-Fundy area. Biological and catch-effort information is insufficient to evaluate the status of more than a few stocks of alewives and blueback herring. This paper examines the status, from 1960 to 1997, of alewife and blueback herring stocks (hereafter termed alewives unless specifically differentiated) in Scotia-Fundy area based on fisheries landings, licenses issued, and logbook-reported catch-per-unit-effort (CPUE). Catch and CPUE trends are presumed indicative of relative abundance.

Historical Perspective

The present abundance of alewives was greatly exceeded by their colonial abundance but, even then, their abundance markedly declined in response to industrial development (Perley 1852; Knight 1867). Perley (1852) commented that "...the gaspereau fishery has been considered of so much importance, that various Acts of Assembly have, from time to time, been passed for its regulation and protection. But these laws have either been neglected, or not properly enforced, and this fishery is rapidly declining. Very slight obstructions suffice to prevent the gaspereaux from ascending streams to their old haunts; the dams for mills, or for driving timber, have shut them out in numerous instances from their best spawning grounds, and the greatest injury has in this way been inflicted on the fishery." Most such dams have long since been removed and fish passage has been provided at most remaining dams, although downstream passage at hydroelectric dams remains inadequate, occurring primarily via turbine passage. The creation of large headponds behind the dams has enhanced the production of alewives in some cases, e.g., Mactaquac Dam headpond (Jessop 1990), Gaspereau Lake (Jessop and Parker 1988). Environmental degradation, including acid precipitation in geologically sensitive areas, such as southwestern Nova Scotia (Watt et al. 1983; Klauda et al. 1991), is now of concern but the extent of the potential problem has not been quantified.

Biology

Anadromous alewives occur in virtually all suitably-sized and accessible rivers in Scotia-Fundy area. Blueback herring occur in fewer rivers, most notably in the Saint John and Tusket rivers, and are less abundant than alewives where both species occur. Blueback herring comprise about 30-40% of the run in the Saint John River (Messieh 1977; Jessop et al. 1983), and about 20% of the run in the Tusket River (Stone et al. 1992). Spawning migrations of alewives into rivers typically begin in late April or early May, depending upon geographic area and water temperature, peak in late May or early June and are completed by mid-July. Blueback herring enter the river 2-3 weeks later than do alewives. Both species return with substantial fidelity to their natal river (Messieh 1977; Jessop 1990) and return to sea soon after spawning.

Alewives and blueback herring recruit by platoons to the spawning stock and to the fishery over 2-4 years. Spawning occurs first in both species at age 3 and virtually all fish have spawned by age 6. The mean age at first spawning is older for alewives than for blueback herring and is usually older for females than for males of each species. Repeat spawners may form a high proportion (35-90%) of the stocks of both species, with higher proportions of repeat spawners where exploitation is low.

Catch and License Statistics

Catch (landings; tonnes) statistics (more properly sales statistics) for alewives are reported from 1960 to 1997 for Fishery Statistical Districts (FSD) in the Scotia-Fundy area (Table 1; Figure 1). Catch statistics may be inaccurate because catches were sometimes landed or sold in an FSD different from the one where capture occurred and records were maintained with variable thoroughness. For example, the inaccurate, low reported catches in FSDs 33 and 34 between 1978 and 1988 resulted from incompleteness in the collection of sales slips and in the completion and submission of Supplementary "B" forms which estimate the gaspereau catch not sold to buyers. In the early-1980s, individual fishermen made a transition

from the use of sales slips to the use of logbooks and Supplementary B reports by Fishery Officers were generally phased out. Logbooks permitted collection of effort as well as catch statistics. Introduction of the logbook varied among FSDs; the Saint John River area began use of a logbook in 1979, with the remainder of Scotia-Fundy area starting in 1981. Unfortunately, the quality of implementation varied among FSDs and logbook use was not legally enforceable until 1993 when changes were made to the Fishery (General) Regulations to allow the requirement for logbooks as a condition of license. This resulted in no returns or returns that varied in completion from poor to mediocre because, during this transition period, the sales slip system was phased out. With neither system fully operational between 1979 and 1992, the catch statistics for this period probably underestimate true catches, perhaps substantially, and should be used with caution. The aggregation of catch and fishing effort by FSD obscures the analysis of trends in particular rivers within FSDs. Since 1997, river system has been included as a data entry variable.

Since 1993, new commercial gaspereau fishing licenses have been limited in the Scotia-Fundy area, except in the Tusket River area and for a few other justified exceptions. The number of licenses issued imperfectly indicates fishing effort because individual fishers may have licenses for several gear types, each license may authorize multiple units of a particular gear, and not all licenses or authorized gear units are fished each year. Thus, a trap net license may authorize from one to, perhaps, a dozen trap nets or a gill net license from one to several nets of possibly variable length (among fishers and FSDs). In 1997, a comparison of the number of gaspereau licenses issued (657) and those fishers reporting catches (418) suggests that about 64% of licensed fishers fished in that year (assuming that the 114 fishers that did not submit a logbook, as required, did not fish).

Catch Trends

Reported catches of alewives in Scotia-Fundy area fluctuated from 1,559 t to 7,346 t between 1960 and 1997 (Figure 2A). Catches since 1990 have declined below the 38-yr mean of 3,491 t and are within the lower quartile of the historic range. The total catch of alewives in Scotia-Fundy area since 1960 is apportioned 38:62% to Nova Scotia:New Brunswick. Between 1960 and 1997, Nova Scotia catches of gaspereau ranged between 421 t and 2,906 t. Catches declined from the late 1970s peak to a misleadingly low level during the early-to-mid 1980s, driven by the inaccurate, low catches reported from the large fishery of the Tusket River area. Catches peaked again in 1989, then declined to near historic lows and have recently risen above the long-term mean of 1,316 t. If the misleading low gaspereau catches of 1981-1984 are ignored, catches in 6 of the 14 remaining years since 1980 have exceeded the Nova Scotian long-term mean catch. New Brunswick catches of gaspereau during the 1960-1996 period have ranged from 628 t to 6,455 t. Catches in New Brunswick have trended downward since the 1971 peak, were low during the early 1980s, then increased moderately during the late 1980s before declining again to the record low of 628 t in 1994 before recovering slightly. New Brunswick gaspereau catches have remained below the long-term mean of 2176 t since 1990. Since 1973, annual fluctuations in catch have varied closely ($r = 0.80$, $n = 25$, $P < 0.001$) in both Nova Scotia and New Brunswick portions of the Scotia-Fundy area, although the excessively low catches of the early-to-mid 1980s in Nova Scotia may improve the observed relation. The trend similarity may indicate cyclical population reactions to fishing pressure or market forces, or to other, perhaps environmental, factors.

Fisher response to regional market demands is not likely a major factor. Sales prices (presumably reflecting market demand) are not well correlated with catch in either province (for N.S., $r = -0.01$, $n = 28$, $P = 0.95$; for N.B., $r = -0.01$, $n = 30$, $P = 0.96$), after removal by differencing of the negative correlation due to declining catch and rising price trends (Figures 2A, 2B). Inflation adjustment of prices would also reduce or eliminate the apparent temporal rise in price. The sharp fall in catch and price between 1989 and 1990 resulted in a significant correlation between catches and prices for gaspereau in Nova Scotia ($r = 0.45$, $n = 31$, $P = 0.01$). Deletion of these two points produced the non-significant relation for Nova Scotia given above and which is consistent with the New Brunswick relation. Fishing effort may reflect the perceived abundance of fish and the opportunity to earn higher incomes with larger catches as long as demand remains sufficient to accept larger catches, whether prices remain stable or even fall.

Few time series of environmental data are available relevant to regional gaspereau survival either in fresh or marine waters (Drinkwater 1996). Gaspereau likely overwinter over the central and southern Scotian

Shelf and Georges Bank (Stone and Jessop 1992) but no sufficiently-long time series of water temperatures (perhaps influencing survival) exists for these areas. An extensive time series of water temperatures exists for Halifax Harbour and the Prince 5 site at the mouth of the Bay of Fundy (K. Drinkwater, Department of Fisheries and Oceans, Bedford Institute of Oceanography, Dartmouth, NS, personal communication) but their relevance to Scotian Shelf conditions is low. No significant ($P < 0.05$) correlation, at any plausible lag (1-10 years), exists between annual water temperatures (5-year moving average) in Halifax Harbour or annual water temperatures at the Prince 5 site and the detrended (by differencing) time series of annual reported catches between 1960 and 1997 from the Scotia-Fundy area, Nova Scotia and New Brunswick. No significant correlation was found between Halifax Harbour or Prince 5 water temperatures and annual catches between 1950 and 1997 for the Saint John River (excluding Mactaquac Dam catches). The three peaks (1954, 1971, 1989; spaced 17 and 19 years apart) in Saint John River gaspereau catch (Figure 4) and similar peaks in the provincial (N.S., N.B.) catch (Figure 1) may result from a cyclical "fishing up" effect. This effect arises when excessive fishing effort produces short-term high catches then prolonged decline until the stock recovers following a reduction in fishing effort (Ricker 1975). The factor(s) influencing catch levels in a co-ordinated manner throughout the Scotia-Fundy area remains obscure.

Landings reported by FSD (Table 1) typically include several rivers; catches for a single river can rarely be obtained. However, landings from a single large river may dominate commercial landings within one or several adjacent FSDs. This permits the examination of catch trends in certain major rivers. Significant landings of gaspereau may occur in coastal regions where local rivers are minor producers of gaspereau, e.g., FSD 1 where the gaspereau catch is largely bycatch in the mackerel trap nets of Aspy Bay, Cape Breton.

Annual alewife landings have varied greatly among FSDs and their associated rivers. Within Nova Scotia, catches in the LaHave, Mersey and Medway (combined), Gaspereau and Shubenacadie rivers have declined irregularly to low levels since the mid-to-late 1970s peaks while catches in the Tusket river have increased (Table 1, Figures 2 and 3). Within southwestern New Brunswick (and the Scotia-Fundy area), the most important alewife fishery has historically occurred in the Saint John River. This fishery can be divided into three parts: the drift and set gill-net fishery in Saint John Harbour (FSDs 48,49), the trap-net fishery in the mainstem tributaries (FSDs 55,56,57), and the fishery at the Mactaquac Dam. Since the late 1960s, the harbour fishery has usually composed about five percent of the total river fishery, but this percentage increased sharply in the late 1980s (Table 1, Figure 4) due to both increased catches in the harbour and decreased catches upriver since the early 1970s. The catch of the upriver (FSDs 55-57) trap-net fishery has, since 1980, been relatively stable and below its 48-yr (1950-1997) mean of 1,790 t, fluctuating between 676-1,283 t, except for the 1993-4 lows (369-576 t). Since 1980, the trap-net fishery has exceeded its long-term mean in only two years. The Mactaquac Dam fishery takes, on average, about 22% (range 6-41%) of the total river catch but that proportion has declined recently to about six percent as catches have increased in the river and declined at Mactaquac Dam, partly due to increased spawning escapements at the Mactaquac Dam. The total annual harvest of alewives in the Saint John River has been lower than its 1950-1997 mean of 2,350 t since 1979 (Figure 4).

License and Catch/effort Trends

Total numbers of licenses for various gear types (gill net, fixed and drift; trap net, including square net; dip net) have been relatively stable during the period 1988-1997 (chosen so that catch/effort data from logbooks could also be examined). After 1992, the number of dip net licenses increased in Nova Scotia (Table 2), particularly in the Tusket River area (Table 3). Before 1992, gill net licenses outnumbered all other license types in the Scotia-Fundy area and in its provincial components, followed by dip and trap net licenses. Since 1993, dip net license numbers have exceeded those of gill nets. The gear quantities permitted by different licenses vary. One dip net is permitted per dip net license, but a gill net license may authorize varying numbers or lengths of gill net. Trap net licenses may authorize from one to a dozen or more trap nets, particularly on the Saint John River where the 12 licensed trap net fishers were authorized 103 traps in 1996 and 1997 (Table 6).

The pattern of gear use varies among individual rivers depending on the physiography of the estuary and lower river. Dip nets are most used on the LaHave and Mersey-Medway rivers. Gill nets and dip nets

are about equally common on the Tusket River. Trap (square) nets dominate on the Gaspereau River. Gill nets are most used on the lower Shubenacadie River and in Saint John River Harbour, while trap nets are used in the upriver fishery on the Saint John River (Table 3).

Fishing power obviously varies among gear types. Within the Scotia-Fundy area, dip- and gill-net catches dominate the fishery in Nova Scotia and trap- net catches dominate the fishery in New Brunswick (Table 4). The large number and active use of dip nets in Nova Scotia produces total catches and catch/hour (CPUE) rates exceeding those for gill nets. Trap-net catches in New Brunswick greatly exceed dip-net catches but, in Nova Scotia, dip-net CPUE substantially exceeds trap-net CPUE. In each province, reported gill-net effort was much greater than for all other gear types, but CPUE was much less. The CPUE for the gill-net fishery was calculated as (catch/(fathoms of net x hours fished))*1000 to adjust for the annually variable length of gill net authorized for the fishery. CPUE for the gill-net fishery was reported as kg/h for simplicity. The actual quantity of gill net annually deployed is unknown. The more simple estimate of CPUE (catch/hours fished) was highly correlated with the previous estimator (in five of six rivers, $N = 10$, $r > 0.92$, $P < 0.001$; for the Shubenacadie River, $r = 0.74$, $P < 0.02$). The simple CPUE estimator may provide as useful an indicator of CPUE value and trend for the gill-net fishery within a given river as does the more complex estimator but is not as suitable for comparisons among rivers.

In Nova Scotia, gill net fishing effort more than doubled (from about 100,000 h to over 200,000 h) between 1988 and 1997, catches varied greatly (from about 330,000 to 617,000 kg), and CPUE fell (from about 0.18 to 0.10 kg/h) (Table 4; Figure 1A). Dip-net catches varied (340,000 to 900,000 kg, excluding the anomalous year 1989) while fishing effort increased greatly (5,200 to 27,100 h) while CPUE declined (83 to 18 kg/h). Trap-net catch generally declined (from about 200,000 to 70,000 kg), yet fishing effort increased (from about 2,600 to 6,600 h) while CPUE declined sharply (from about 70 to 15 kg/h). In New Brunswick, catch generally increased then declined (255 to 577 to 207 t) for the gill net fishery and rose then fell before recovering (over 1,000 to 303 to 995 t) for the trap net fishery. Fishing effort by gill net increased (from 40,000 to 100,000 h) before declining to 66,000 h and trap-net fishing effort increased irregularly from about 20,000-43,000 h. CPUE declined for the gill-net fishery (from about 0.6 to 0.2 kg/h) and declined then recovered slightly (about 44 to 11 to 25 kg/h) in the trap net fishery. The increase over time in logbook response rate results in underestimation of the total catch and effort in earlier years relative to later years with higher response rates.

The annual trends in CPUE among gear types may be more reliable as an indicator of fishing success. In all gill, trap, and dip net fisheries (except the minor dip net fishery in New Brunswick) in New Brunswick and Nova Scotia, CPUE declined between 1988 and 1997. When the 1988-1997 decline in catch (all gear types combined) and decline in CPUE of individual gear types are viewed in the larger context of the time period since 1960, it is evident that both catch and stock abundance have, during the 1990s, declined well below their longer term means.

The catch trends in certain large fisheries further illustrate the annual variability in catches among different gear types and the general decline in CPUE between 1988 and 1997 (Tables 5 and 6; Figures 5 and 6). Thus, in the LaHave-Petite rivers, dip-netters consistently harvested the major portion of the catch. Annual dip-net CPUE has varied greatly, ranging from about 152 kg/h in 1988 to 10 kg/h in 1992 but typically fluctuating between 20-80 kg/h (Table 5; Figure 4). In the Mersey-Medway rivers, gillnet catch declined from over 40 t in 1988 to 9 t in 1992 then levelled off while effort increased to about 20,000 hr until 1991 then declined to 7,000 h, resulting in a declining then rising CPUE (1.5-0.3-1.0 kg/h). Dipnet catches in the Mersey-Medway rivers declined through 1990 then recovered (about 135-10-100 t), as did CPUE (about 90-20-60 kg/h), while fishing effort remained relatively stable (about 900-2,400 h). Tusket River gillnet catches were stable (237-284 t) between 1988 and 1990, increased sharply in 1991 (513 t) then declined in 1992 (163 t), and finally increased to over 430 t in 1995 and 1996. The high 1991 catch was driven by increased fishing effort since CPUE declined between 1988 and 1992 (0.4-0.1 kg/h) while the low 1992 catch had a moderately high fishing effort (125,000 h). After 1992, gill net catches on the Tusket River increased (about 270-450 t) while fishing effort (about 170,000-200,000 h) and CPUE (0.1-0.2 kg/h) remained stable.

The increased gaspereau catch in the Tusket-Annis rivers during the early 1990s can be attributed to increased production in the Carlton River tributary of the Tusket River following improved fish passage after the opening of the Carlton River fishway in March of 1989. The substantial increase in number of dip net licenses and fishing effort in the Tusket River area since 1992 will make the high catches of recent years

short-lived if the exploitation rate becomes excessive. The low dip-net catch on the Tusket River in 1997 was attributed to poor water conditions by the fishermen but is more likely due to continued excessive fishing effort. The exploitation rate (dip- and gill net fisheries) was estimated at 81% based on the estimated escapements at the Raynaud Lake fishways (N.S. Power Corporation, personal communication) and the reported commercial catch for the Tusket River. Exploitation rates continually exceeding about 78% lead to stock collapse (Crecco and Gibson 1990). Exploitation rates should not exceed about 64% for alewives and should be much less to rebuild a depleted stock.

In the Scotia-Fundy portion of New Brunswick, the alewife fishery is dominated by the Saint John River fishery, which in turn is driven by the upriver trap net fishery. Trap net catches and CPUE in the upriver fishery greatly exceed those for the harbour gill net fishery (Table 6, Figure 6). The gill-net fishery catch in Saint John harbour (FSDs 48,49) increased from about 223 t in 1988 to 544 t in 1990 then declined to 89 t in 1996 before rebounding in 1997 to 173 t. Fishing effort increased from about 28,000 h to 90,000 h between 1988 and 1992 then declined to 21,000 h before increasing to 50,000 h while catch/effort varied between 0.2-1.2 kg/h but generally declined over the period. The logbook reporting-rate increased from 38% to over 90% during this time. The reported catch of the upriver (FSDs 55,56,57) trap-net fishery declined from 1,026 t to 777 t, effort increased from about 20,000 h to over 36,000 h (reflecting an increase in reporting rate from 33% to over 90%), and CPUE declined from almost 45 kg/h to 11 kg/h (about 76%) before rising to about 20 kg/h. In 1991, about 51 of the 133 authorized trap nets were fished while, in 1996, 59 of 103 were fished. Thus, as fish abundance (represented by higher CPUE) increased, fishing effort and catch increased also.

Fishers evidently respond rapidly to indications of increased fish abundance.

Jessop (1986) concluded that the gaspereau stock of the lower Saint John River was heavily overfished and the situation has improved little since then. About 48 trap nets were estimated as sufficient to harvest a "recovered" stock on a sustainable basis, with substantially fewer necessary until the stock has shown evidence of recovery. Although anecdotal fisher comments have indicated much reduced fishing effort in recent years relative to the 1970s and 1980s, the high overhang of unfished gear should be of concern (Table 6). Such excess gear, coupled with a tendency to utilize more gear when fish abundance has perceptably increased, could dampen any stock recovery, limit future fishery catches to the low levels occurring since the late 1970s, and perpetuate fishery-induced cycles in stock abundance.

Since the late 1980s, the common trends among three South Shore, Nova Scotia rivers and the Saint John River, New Brunswick, have been a declining catch and CPUE through the early 1990s followed by moderate recovery. The synchrony in Nova Scotia-New Brunswick catch trends since the early 1970s is consistent with the short-term similarity in catch trends among rivers with large fisheries in both provinces.

Conclusions

Substantial variability in alewife catch occurs annually within Scotia-Fundy area. Catches in recent years have trended downward, reaching near-historic lows, although some recovery has recently occurred. Nonetheless, catch levels in most major rivers are sufficiently below their long-term means that a reduction of fishing effort may be necessary in these rivers if future catches are to be increased. Otherwise, the prognosis is for catches to fluctuate about the levels observed since the 1980s. The statistical base is inadequate to conduct intensive analyses of catch/effort but perceptions of general trend in various fisheries are probably reliable. The fishing power available in most, if not all, rivers exceeds that required to fully exploit the resource. In most rivers less gear is being fished than is authorized, but additional reductions in fishing effort in specific situations will be required to improve individual stock abundance and future sustainable catches. Improvements in the completeness of logbook catch/effort data offer hope that a more reliable time series of data may be developed, which, in turn, may lead to improved fishery management.

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Table 1. Annual alewife landings (t) by Fishery Statistical Districts (FSD's) for Scotia-Fundy region (Nova Scotia and New Brunswick, 1960-1997). * Landings from FSD 3 were separated from the Gulf Region in 1984. ** Mactaquac Dam. Dash indicates either no data or zero catch. Note: some FSD's with small catches in a few years have been omitted.

	Fisheries Statistical District																						
Year	1	*3	4	6	7	8	9	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
1960	25	-	6	8	3	1	2	2	3	-	7	-	9	3	-	-	<1	-	3	3	25	162	1
1961	15	-	-	24	37	-	6	-	-	-	1	-	18	4	-	-	-	-	1	-	33	107	3
1962	3	-	-	26	13	-	17	-	-	-	2	-	16	-	-	<1	1	-	5	-	13	111	<1
1963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1964	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1965	9	-	2	51	6	-	8	-	3	-	16	-	35	5	<1	4	4	-	4	-	84	156	-
1966	41	-	-	2	1	-	-	<1	<1	2	21	-	40	57	-	-	1	-	-	<1	49	361	6
1967	42	-	-	51	1	-	1	-	<1	-	11	-	24	17	<1	2	1	-	-	-	166	233	-
1968	-	-	<1	5	12	-	<1	3	-	<1	22	-	43	33	<1	1	-	-	<1	-	259	560	4
1969	1	-	-	19	<1	2	8	-	-	<1	5	-	17	46	<1	3	<1	-	-	-	63	115	-
1970	1	-	-	3	2	-	12	-	<1	1	6	-	10	11	<1	3	1	-	-	-	19	96	<1
1971	2	-	-	5	3	-	10	<1	-	1	8	-	7	10	1	<1	1	-	-	-	105	128	4
1972	5	-	-	68	7	-	10	2	<1	2	49	-	25	6	-	-	<1	-	<1	-	39	71	1
1973	12	-	2	92	5	-	7	14	<1	8	46	-	7	19	2	2	<1	-	1	2	19	621	4
1974	57	-	-	220	4	-	10	4	6	6	32	-	21	40	<1	<1	<1	-	4	60	15	587	10
1975	43	-	-	110	2	-	18	-	11	4	40	-	99	199	<1	1	9	<1	19	26	<1	118	12
1976	15	-	-	21	-	-	56	7	1	1	20	-	51	142	<1	<1	4	-	31	131	34	256	6
1977	27	-	-	26	<1	-	41	-	3	5	22	-	93	365	<1	1	8	-	21	180	88	94	5
1978	92	-	-	31	<1	-	55	-	1	3	35	-	113	222	<1	4	34	<1	25	14	184	421	1
1979	56	-	-	63	2	82	89	1	3	4	<1	7	35	149	<1	-	31	<1	31	203	206	333	19
1980	671	-	-	76	4	-	27	-	<1	1	1	10	42	141	<1	7	7	1	3	234	49	195	11
1981	87	-	-	23	15	-	-	-	3	3	20	11	27	188	<1	10	1	1	67	26	36	287	8
1982	3	-	-	<1	5	-	2	-	-	1	8	6	8	111	-	5	11	1	48	58	50	120	3
1983	7	-	9	6	28	-	9	-	<1	-	12	1	<1	115	-	4	3	<1	<1	23	23	63	6
1984	147	2	-	7	25	-	8	-	-	-	-	-	12	103	<1	-	-	-	-	48	32	164	16
1985	234	7	5	8	13	5	58	-	-	-	-	-	13	106	<1	7	13	-	28	76	181	231	7
1986	11	1	-	35	12	-	5	29	-	-	2	-	9	38	-	13	4	1	-	65	152	288	7
1987	5	-	-	7	13	-	29	122	-	-	5	-	5	87	-	15	4	-	-	137	112	213	2
1988	148	<1	-	1	80	5	63	38	-	-	2	-	14	50	-	-	2	-	-	169	88	355	-
1989	10	5	5	4	14	-	-	-	-	-	2	-	13	37	-	13	3	-	-	-	37	153	3
1990	4	4	<1	21	8	-	-	6	-	-	6	-	13	40	-	9	-	-	-	21	75	154	<1
1991	-	9	16	14	6	-	-	20	-	-	4	<1	10	15	<1	<1	2	<1	-	21	39	51	2
1992	-	27	12	19	9	<1	<1	12	-	<1	2	6	6	8	-	-	-	-	-	8	27	45	<1
1993	-	19	12	28	22	<1	2	12	-	<1	6	3	2	14	-	-	-	-	-	17	36	70	3
1994	6	10	4	30	16	<1	2	7	-	<1	3	-	6	30	-	-	-	-	<1	<1	54	88	2
1995	-	5	5	47	14	<1	4	11	-	<1	6	2	15	41	-	<1	-	-	<1	1	135	171	1
1996	53	5	5	48	6	-	3	6	-	-	9	4	6	15	-	2	-	1	-	3	74	103	2
1997	<1	3	2	48	4	-	1	1	-	-	7	-	3	25	-	<1	-	<1	<1	4	51	88	<1

Table 1. continued.

	Fisheries Statistical District																						
Year	31	32	33	34	35	36	37	39	40	41	42	43	48	49	51	52	53	55	56	57	**58	79	81
1960	-	34	290	3	-	-	-	-	-	49	153	-	-	341	-	-	-	44	1,540	389	-	<1	11
1961	-	37	146	8	-	2	-	-	-	188	156	-	612	654	1	15	-	100	959	454	-	2	12
1962	-	17	92	19	-	-	-	-	-	187	86	-	1,070	9	-	-	-	141	939	708	-	2	12
1963	-	-	-	-	-	-	-	-	-	-	-	-	515	192	-	-	-	66	663	127	-	-	-
1964	-	-	-	-	-	-	-	-	-	-	-	-	367	-	-	-	-	261	590	196	-	-	-
1965	-	-	114	46	-	4	-	-	-	166	45	-	562	166	-	-	-	120	1,528	916	-	3	10
1966	15	-	81	20	-	5	-	-	-	168	30	-	78	8	-	-	-	261	1,105	321	-	3	11
1967	60	-	110	33	-	4	-	-	-	71	6	<1	98	<1	-	-	-	204	417	975	-	3	17
1968	92	5	154	2	-	6	-	-	-	144	59	-	-	18	-	-	-	221	980	931	-	3	11
1969	4	29	185	-	-	16	-	-	-	141	51	<1	13	1	-	-	-	178	1,080	717	-	4	11
1970	29	-	250	-	-	13	-	-	-	143	50	<1	80	2	<1	<1	-	210	1,749	1,464	-	5	11
1971	61	-	291	5	-	10	-	-	-	206	32	-	52	98	-	-	30	114	4,769	1,386	-	5	<1
1972	<1	80	441	12	-	16	-	-	-	176	51	-	16	-	-	14	-	250	2,569	1,195	-	6	-
1973	-	46	772	12	-	10	-	-	-	301	146	-	34	19	1	<1	-	231	1,287	976	-	201	-
1974	77	<1	700	25	-	-	-	-	-	374	97	26	6	6	-	6	-	264	1,515	1,337	157	8	-
1975	<1	75	504	16	-	-	-	-	<1	458	177	<1	19	12	1	16	-	153	955	764	322	8	-
1976	1	312	484	158	-	-	-	-	-	643	311	-	29	4	-	11	496	149	949	972	572	782	-
1977	<1	99	502	26	-	-	-	41	<1	551	318	366	31	<1	-	-	222	156	1,612	650	877	10	-
1978	-	66	-	4	-	-	2	-	-	606	424	28	58	-	-	83	-	179	1,323	719	991	11	-
1979	<1	43	<1	-	-	-	-	-	-	248	5	500	-	-	-	11	-	143	886	644	610	-	-
1980	-	-	36	49	2	4	-	-	81	134	218	32	525	72	-	-	-	88	288	146	846	-	-
1981	<1	11	-	-	-	-	-	-	-	53	4	1	16	88	-	-	-	22	760	88	466	-	-
1982	14	9	86	8	<1	-	-	-	<1	52	109	-	16	42	-	28	-	13	565	277	258	-	-
1983	-	-	30	3	-	-	-	-	<1	53	7	17	31	48	-	-	-	30	508	349	172	-	-
1984	-	-	198	92	7	-	-	-	-	62	-	-	2	109	-	-	-	17	583	[illegible]	281	-	-
1985	1	1	25	31	-	-	-	-	-	350	11	-	-	46	-	3	-	22	636	61	398	2	2
1986	4	-	48	9	-	2	-	-	-	272	16	10	85	37	-	10	-	18	519	150	0	-	-
1987	1	1	141	22	-	-	-	-	-	337	159	12	217	72	-	11	-	116	590	319	611	1	-
1988	1	-	220	30	-	2	-	-	-	73	93	13	20	291	82	10	1	159	709	321	615	1	-
1989	6	-	437	77	-	68	-	-	-	200	65	10	90	285	-	6	-	560	438	2	969	1	2
1990	-	-	235	42	-	6	-	-	-	432	220	11	218	632	-	62	-	322	256	298	123	5	11
1991	1	-	403	162	-	-	-	-	-	198	92	8	254	40	-	88	-	198	497	443	217	1	1
1992	<1	-	221	92	-	<1	-	-	-	45	125	12	336	16	-	12	<1	54	333	405	277	2	-
1993	2	-	280	274	-	2	-	-	-	72	61	33	237	5	-	2	-	82	255	239	145	3	<1
1994	<1	-	338	374	-	19	-	-	-	149	43	24	172	13	-	6	-	60	146	138	79	1	13
1995	1	<1	562	415	-	35	-	-	-	171	37	6	160	3	-	4	<1	41	327	388	55	2	-
1996	1	-	548	472	-	6	-	-	-	60	48	10	130	3	-	1	-	13	662	252	63	5	21
1997	2	5	310	266	-	3	-	-	-	63	32	13	175	17	-	2	-	101	519	370	338	12	7

Table 2. Number of commercial alewife fishing licences by gear type for Nova Scotia, New Brunswick and the Scotia-Fundy area (1988-1997). GN - gill net (set and drift); TN - trap net (including square net); DN - dip net. The number of licenses issued to fishers may be less than the sum of licenses issued for each gear type because individuals may be licensed for more than one gear type. Trap net licenses may authorize multiple nets and gill net licenses may authorize variable lengths of net.

	Scotia-Fundy				Nova Scotia				New Brunswick			
Year	GN	TN	DN	Total	GN	TN	DN	Total	GN	TN	DN	Total
1988	389	63	217	559	262	47	211	415	127	16	6	144
1989	391	67	252	578	266	47	247	437	125	20	5	141
1990	397	66	256	575	275	47	250	438	122	19	6	137
1991	389	64	238	551	268	45	230	413	121	19	8	138
1992	392	68	268	574	273	48	264	442	119	20	4	132
1993	379	64	411	688	264	45	407	563	115	19	4	126
1994	360	57	438	688	254	42	431	571	106	15	7	117
1995	375	67	508	773	261	48	506	655	114	19	2	118
1996	353	63	460	687	250	46	453	591	103	17	7	96
1997	333	64	444	670	239	47	437	569	94	17	7	101

Table 3. Number of commercial alewife fishing licences by gear type for major river systems in the Scotia-Fundy areas of Nova Scotia and New Brunswick (1988-1997). GN - gill net (set and drift); TN - trap net (square net on the Gaspereau River); DN - dip net; tot - total; FSD - Fisheries Statistical District. A dash indicates either gear type not used or no data. The total number of licenses issued to fishers may be less than the sum of licenses issued for each gear type because individuals may be licensed for more than one gear type. Trap (and sometime dip) net licenses may authorize multiple nets and gill net licenses may authorize variable lengths of net.

Nova Scotia

	LaHave-Petite (FSD 26,27)				Mersey-Medway (FSD 28)			Tusket-Annis (FSD 33,34)			Gaspereau (FSD 41)				Shubenacadie (FSD 42,43)		
Year	GN	TN	DN	Total	GN	DN	Total	GN	DN	Total	GN	TN	DN	Total	GN	DN	Total
1988	2	-	27	28	13	34	41	65	53	66	6	15	1	21	60	5	66
1989	3	-	9	12	15	48	51	65	82	71	6	16	-	21	64	6	70
1990	3	-	12	12	15	40	43	64	70	72	6	14	1	20	63	5	67
1991	3	-	10	13	14	39	42	64	64	75	6	14	1	21	63	5	67
1992	3	-	10	12	14	32	35	62	97	107	6	13	-	18	61	5	67
1993	3	1	23	24	15	37	41	63	191	198	4	15	1	19	60	6	65
1994	2	1	35	39	15	31	33	64	214	221	4	15	-	19	60	6	65
1995	2	1	40	40	15	30	32	65	284	292	4	14	-	18	60	5	64
1996	2	1	30	34	13	27	29	65	223	229	4	14	-	18	52	4	55
1997	2	1	32	32	13	26	28	62	236	242	4	15	-	19	48	4	51

New Brunswick

	Saint John Harbour (FSD 48,49)				Upper Saint John (FSD 55,56,57)		
	GN	TN	DN	Total	GN	TN	Total
1988	71	2	1	71	43	15	53
1989	70	2	1	71	41	15	51
1990	68	2	1	69	41	14	50
1991	68	2	1	69	38	14	37
1992	62	2	1	63	39	14	48
1993	63	2	1	61	38	16	46
1994	63	2	1	61	37	14	43
1995	61	2	1	59	34	14	40
1996	55	2	1	53	27	12	31
1997	52	2	1	50	27	12	31

Table 4. Alewife catch and effort values and number of commercial fishers reporting catch, by gear type, for the Scotia-Fundy area based on logbook returns, 1988-1997. Gill net catch/h is (catch/(fathom·h)) x 10^3.

	Gill					Trap				Dip				Total
Year	Catch (kg)	Effort (h)	Catch/h (kg/h)	Fathoms of net	No. of fishers	Catch (kg)	Effort (h)	Catch/h (kg/h)	No. of fishers	Catch (kg)	Effort (h)	Catch/h (kg/h)	No. of Fishers	Response rate (%)
Scotia-Fundy area														
1988	587,180	100,710	0.12	48,701	156	1,244,480	25,670	48.5	20	441,410	5,500	80.3	30	40
1989	774,180	141,260	0.11	48,251	136	1,014,060	21,410	47.4	20	2,207,150	5,850	377.6	41	37
1990	927,840	149,460	0.13	48,952	155	1,213,220	42,250	28.7	29	497,920	6,360	78.4	46	46
1991	1,086,940	261,820	0.08	49,182	208	1,360,910	35,190	38.6	38	391,990	8,370	43.3	60	75
1992	615,200	257,910	0.05	46,373	217	869,360	35,950	24.2	36	355,470	12,930	27.5	67	83
1993	650,920	292,560	0.05	46,496	215	676,170	34,720	19.5	36	466,960	19,030	24.5	134	75
1994	690,400	336,590	0.04	46,188	233	457,450	35,410	12.9	40	609,910	18,970	32.2	154	78
1995	786,570	320,470	0.05	45,264	252	923,960	52,970	17.4	53	903,050	21,890	41.3	231	89
1996	688,950	277,180	0.07	37,444	195	996,520	42,940	23.2	36	865,600	20,960	41.3	168	79
1997	582,160	278,780	0.05	39,944	333	1,066,390	54,290	19.6	64	486,980	27,130	18.0	188	83
Nova Scotia														
1988	332,190	59,090	0.18	32,091	81	207,620	2,630	78.8	13	433,030	5,220	82.9	29	32
1989	382,450	100,930	0.12	31,611	97	199,810	2,820	70.9	14	2,201,390	5,620	391.9	40	39
1990	350,540	97,760	0.11	32,372	98	177,160	5,390	32.9	22	492,560	7,130	80.4	44	40
1991	590,670	182,940	0.10	32,482	132	142,890	5,020	28.5	25	337,960	7,800	43.3	57	70
1992	244,480	158,220	0.05	30,843	143	84,870	3,530	24.0	24	352,530	12,320	28.6	66	80
1993	390,750	209,950	0.06	30,576	151	118,700	4,380	27.1	26	461,870	18,920	24.4	133	74
1994	444,990	247,340	0.06	30,208	160	154,190	7,430	20.8	29	609,090	18,950	32.1	152	76
1995	617,290	257,770	0.08	29,944	182	168,690	10,040	16.8	38	903,050	21,890	41.3	231	88
1996	588,500	249,510	0.10	24,854	149	69,740	5,420	12.9	25	846,550	20,760	40.8	167	77
1997	375,570	216,580	0.07	26,814	145	71,160	4,290	16.6	25	486,390	27,130	17.9	187	83
New Brunswick														
1988	254,990	41,620	0.37	16,610	75	1,025,860	23,040	44.5	7	8,390	270	30.8	1	65
1989	391,730	40,330	0.58	16,640	38	814,250	18,590	43.8	6	5,760	230	25.3	1	33
1990	577,300	51,700	0.67	16,580	57	1,036,060	36,860	18.8[a]	7	5,360	230	23.4	2	64
1991	496,270	78,870	0.38	16,700	76	1,218,020	30,170	31.1	13	24,030	570	42.5	3	90
1992	370,730	99,690	0.24	15,530	74	784,490	32,420	24.3	12	2,950	610	4.8	1	95
1993	260,180	82,620	0.20	15,920	64	557,470	30,340	18.4	10	5,080	100	48.9	1	80
1994	245,420	89,250	0.17	15,980	73	303,270	27,980	10.8	11	810	20	40.8	2	90
1995	169,280	62,700	0.18	15,320	70	755,270	42,940	17.6	15	-	-	-	-	93
1996	100,450	27,670	0.29	12,590	46	926,780	37,520	24.7	11	19,050	200	94.8	1	86
1997	206,600	66,210	0.24	13,130	50	995,240	50,000	19.9	14	590	9	65.5	1	83

[a]Some catches have no associated effort and were not included when catch/hour was calculated.

Table 5. Alewife catch and effort values and number of commercial licenses issued, by gear type, for the LaHave-Petite (FSD 26,27), Mersey-Medway (FSD 28), Tusket (FSD 33,34), Gaspereau (Kings Co.; FSD 41), and Shubenacadie (FSD 42,43) rivers based on logbook returns, 1988-1997. A dash indicates either gear not used or no data. Catch/h for the gill-net fishery represents catch/((fathom·h) x 10^3). Some fishers may have more than one license and each license may authorize more than one gear type - the sum of the licenses for each gear type compared with the total number of licenses issued indicates the number of fishers with more than one gear type.

	Gill					Trap				Dip				Total	Total
Year	Catch (kg)	Effort (h)	Catch/h (kg/h)	Fathoms of net	No. of licenses	Catch (kg)	Effort (h)	Catch/h (kg/h)	No. of licenses	Catch (kg)	Effort (h)	Catch/h (kg/h)	No. of licenses	Licenses Issued	Response rate (%)
LaHave-Petite Rivers															
1988	1,880	480	44	89	3	71,020	400	179.4	1	255,280	1,680	151.9	5	7	32
1989	-	-	-	89	3	-	-	-	1	36,530	930	39.2	7	7	80
1990	3,940	530	84	89	3	21,470	500	42.8	1	66,320	980	67.5	7	9	46
1991	-	-	-	89	3	20,820	420	49.6	1	39,420	660	59.6	11	13	70
1992	2,800	590	53	89	3	8,170	500	16.5	1	14,310	1,370	10.4	10	13	73
1993	3,640	450	46	176	3	16,550	617	26.8	1	33,150	770	43.1	23	24	86
1994	3,830	620	72	86	2	-	-	-	1	51,300	1,830	28.1	39	39	97
1995	5,730	600	111	86	2	7,370	100	76.8	1	123,430	1,560	79.2	40	40	97
1996	5,530	720	89	86	2	-	-	-	1	71,590	1,410	50.6	31	31	85
1997	4,170	520	93	86	2	910	240	3.8	1	18,490	840	22.1	32	32	86
Mersey-Medway Rivers															
1988	40,280	13,830	1.47	1,985	13	-	-	-	0	135,150	1,530	88.3	20	22	54
1989	38,770	16,710	1.03	2,255	15	-	-	-	0	38,100	940	40.5	25	27	54
1990	47,430	20,940	1.00	2,255	15	-	-	-	0	10,610	2,380	44.5	30	32	67
1991	16,250	21,270	0.35	2,195	14	-	-	-	0	34,490	1,820	19.0	40	42	90
1992	8,500	11,680	0.34	2,135	14	-	-	-	0	36,940	1,440	25.7	33	35	97
1993	10,750	12,980	0.38	2,165	15	-	-	-	0	58,830	2,140	27.5	37	41	98
1994	8,260	11,760	0.32	2,165	15	-	-	-	0	80,250	1,280	62.7	31	33	94
1995	15,700	10,180	0.71	2,165	15	-	-	-	0	155,570	2,400	64.8	30	32	100
1996	10,400	6,600	0.83	1,905	13	-	-	-	0	92,120	1,470	62.7	25	27	89
1997	9,090	4,570	1.04	1,905	13	-	-	-	0	78,680	1,550	50.8	26	28	93
Tusket-Annis Rivers															
1988	236,520	39,070	0.44	13,756	65	-	-	-	0	14,060	56	251.1	58	66	41
1989	284,340	68,990	0.30	13,756	65	-	-	-	0	229,980	2,150	107.0	63	71	39
1990	244,880	64,840	0.28	13,286	64	-	-	-	0	31,560	860	36.7	63	72	39
1991	512,520	137,030	0.27	13,815	64	-	-	-	0	53,250	940	56.7	68	75	82
1992	163,470	125,460	0.10	13,046	62	-	-	-	0	149,170	2,180	68.4	100	107	75
1993	266,400	167,030	0.14	11,060	63	-	-	-	0	287,850	10,200	28.2	191	198	72
1994	334,680	201,230	0.15	11,100	64	-	-	-	0	377,130	10,850	34.8	215	221	71
1995	473,330	201,340	0.21	11,106	65	-	-	-	0	502,650	13,410	37.5	286	292	82
1996	430,150	184,100	0.22	10,476	65	-	-	-	0	589,980	13,070	45.1	223	229	72
1997	262,960	178,330	0.14	10,486	62	-	-	-	0	263,050	20,300	13.0	236	242	85

Table 5 (cont.)

Year	Gill					Trap				Dip				Total licenses issued	Total response rate (%)
	Catch (kg)	Effort (h)	Catch/h (kg/h)	Fathoms of net	No. of licenses	Catch (kg)	Effort (h)	Catch/h (kg/h)	No. of licenses	Catch (kg)	Effort (h)	Catch/h (kg/h)	No. of licenses		
Gaspereau River (Kings Co.)															
1988	8,090	280	45.8	642	7	64,740	1,290	50.4	15	-	-	-	-	22	71
1989	2,470	120	38.9	542	6	197,170	2,470	79.8	15	-	-	-	-	21	81
1990	3,010	40	128.9	542	6	224,940	2,520	73.5	14	-	-	-	-	20	35
1991	3,440	340	18.6	542	6	91,560	2,820	32.5	14	-	-	-	1	21	90
1992	4,110	350	21.5	542	5	41,200	1,960	21.0	14	-	-	-	-	18	95
1993	4,960	610	16.9	480	4	67,360	2,120	31.8	15	-	-	-	-	19	100
1994	2,030	190	22.8	480	4	146,950	3,820	38.5	15	-	-	-	-	19	100
1995	20,550	940	45.6	480	4	150,220	3,530	42.6	14	-	-	-	-	19	100
1996	550	60	20.8	480	4	74,300	3,350	22.2	14	-	-	-	-	19	100
1997	450	60	15.2	480	4	63,020	2,260	27.9	15	-	-	-	-	19	79
Shubenacadie River															
1988	39,000	3,340	2.51	4,661	60	-				67,650	1,668	40.6	5	65	61
1989	40,400	1,970	4.05	5,061	63	-				35,230	240	144.4	5	68	51
1990	37,920	1,940	3.87	5,061	63	-				178,880	690	260.0	5	68	60
1991	33,060	2,990	2.17	5,101	63	41,730	196	212.9	1	25,540	1,850	13.8	5	68	94
1992	34,620	2,520	2.73	5,041	61	1,810	60	30.2	1	100,540	5,850	17.2	5	66	88
1993	63,240	3,430	3.52	5,245	60	810	48	16.9	1	28,810	5,280	5.5	6	65	90
1994	56,320	2,900	3.71	5,245	60					10,400	1,970	5.3	6	65	82
1995	22,040	2,100	2.00	5,245	60					21,310	1,210	17.6	5	64	91
1996	44,640	2,710	5.33	3,085	52					13,050	890	14.6	4	48	87
1997	40,340	3,620	2.95	3,775	48					3,890	260	14.8	4	51	92

Table 6. Alewife catch and effort values, licenses issued and number of gear units authorized, by commercial gear type, for Saint John Harbour (FSDs 48,49) and the upper Saint John River (FSDs 55,56,57), based on logbook returns (1988-1997). Dash indicates either gear not used or no data. Trap nets are not used in Saint John Harbour and dip nets are not used in the Upper Saint John River. One dip net is licensed in FSD 48; catch is minor and irregular. Catch/h for the gill-net fishery represents catch/((fathom·h) x 10^3).

	Gill Net					Trap Net					Total
Year	Catch (kg)	Effort (hr)	Catch/h (kg/h)	No. of licenses	Fathoms of net	Catch (kg)	Effort (hr)	Catch/h (kg/h)	No. of licenses	No. gear units	response rate (%)
Saint John Harbour											
1988	223,620	27,540	0.71	71	11,400	-	-	-	2	14	38
1989	363,260	29,790	1.08	70	11,200	-	-	-	2	14	36
1990	544,320	42,010	1.18	68	10,980	-	-	-	2	14	83
1991	293,610	45,830	0.59	67	10,860	-	-	-	2	14	93
1992	345,550	89,380	0.33	65	11,610	-	-	-	2	2	94
1993	239,430	50,160	0.43	63	11,160	-	-	-	2	2	81
1994	159,920	58,490	0.25	63	11,160	-	-	-	2	2	95
1995	162,390	58,140	0.26	61	10,890	-	-	-	2	2	95
1996	89,300	21,080	0.44	55	9,600	-	-	-	2	14	82
1997	173,260	50,420	0.38	50	9,150				2	14	85
Upper Saint John River											
1988	29,010	13,250	0.63	42	3,480	1,025,860	23,038	44.5	15	116	33
1989	28,350	9,920	0.83	41	3,450	814,250	18,590	43.8	15	116	33
1990	21,940	8,850	0.62	41	3,980	856,160	36,860	23.2	14	106	56
1991	75,980	29,830	0.68	38	3,770	1,061,130	32,310	32.8	14	106	94
1992	15,510	9,170	0.51	38	3,290	782,720	32,390	24.1	17	133	93
1993	18,520	32,150	0.18	38	3,290	557,470	30,340	18.4	16	117	89
1994	67,560	28,570	0.73	37	3,260	301,090	27,730	10.9	14	113	91
1995	1,930	3,050	0.21	34	2,960	753,570	42,540	17.7	14	113	98
1996	6,830	5,240	0.56	27	2,330	921,890	37,280	25.4	12	103	93
1997	12,470	8,090	0.66	27	2,330	995,240	50,000	19.9	12	103	82

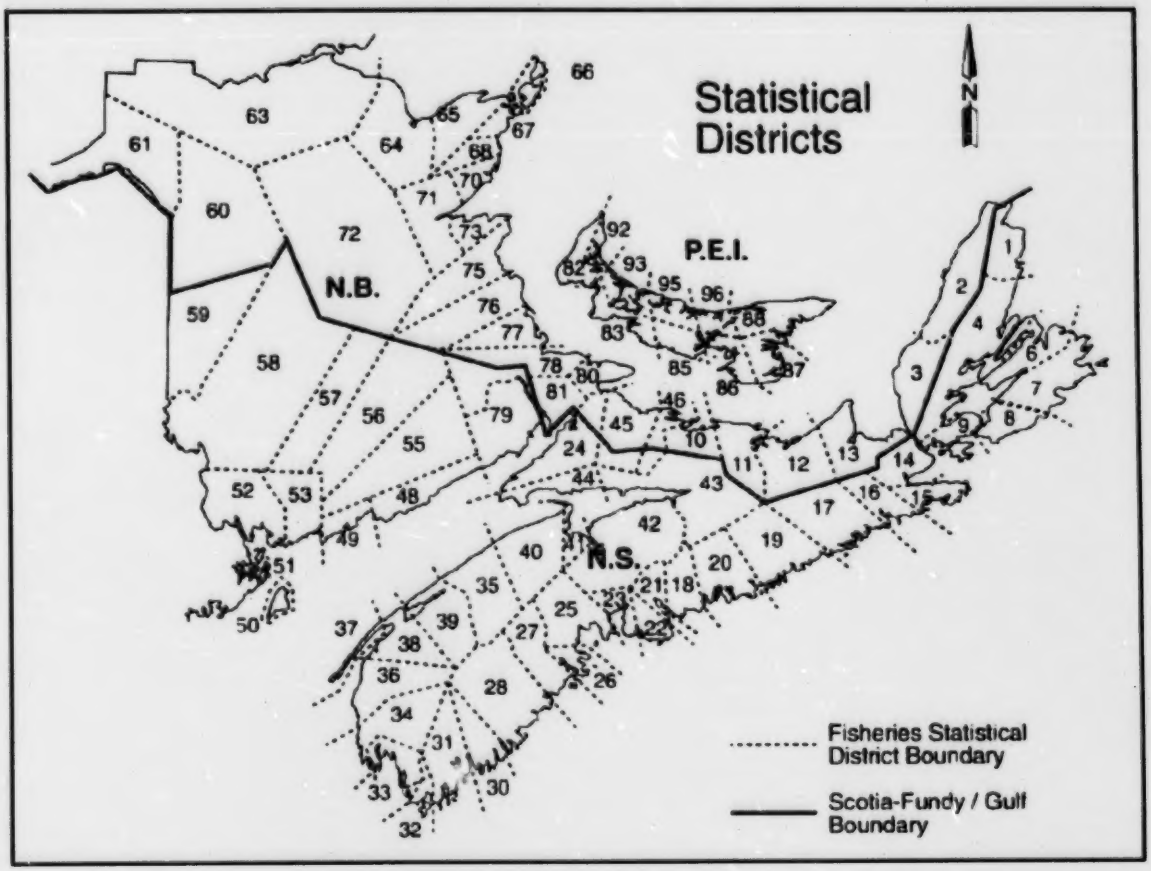

Figure 1. Map of the Maritime Provinces Fishery Statistical Districts (FSDs).

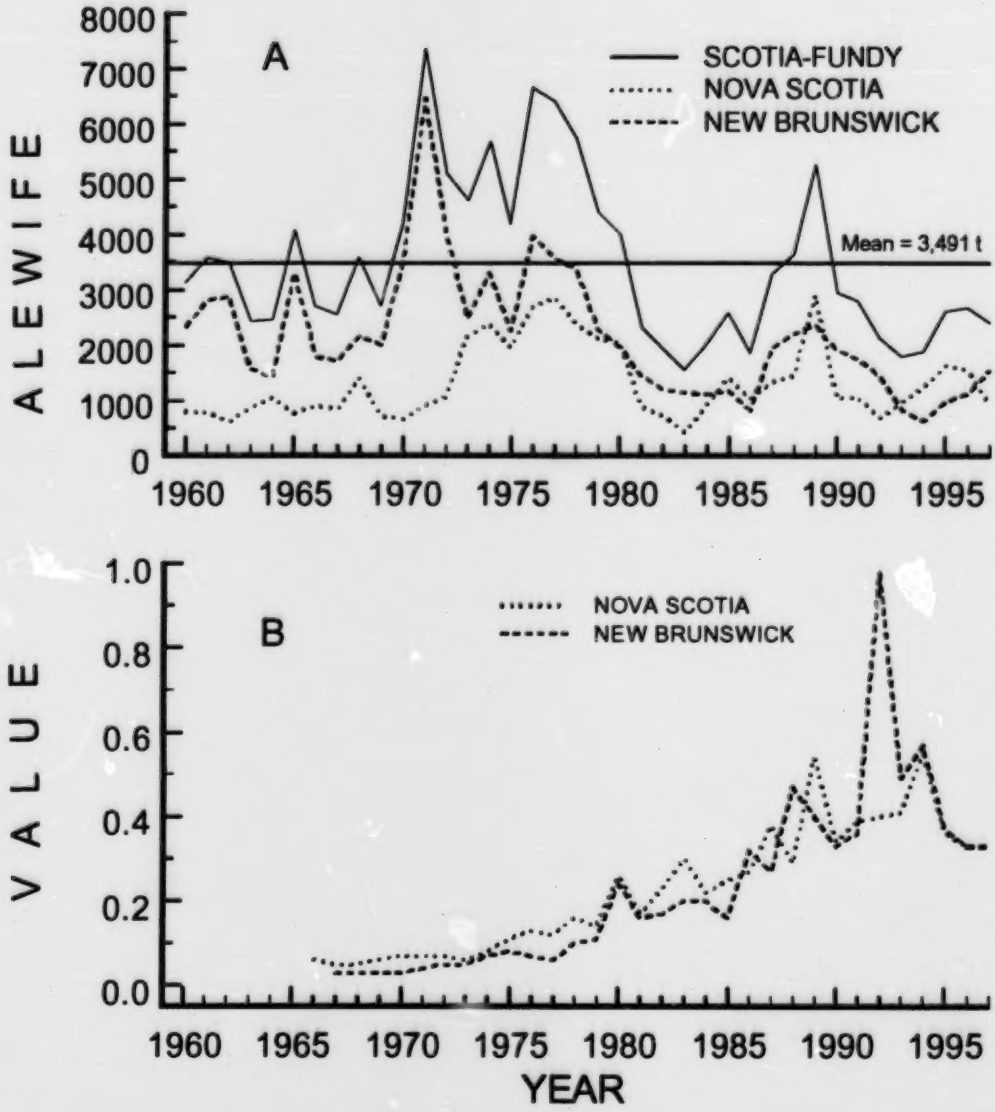

Figure 2. (A) Alewife (and blueback herring) catch (t) in Scotia-Fundy area and by province within the area and (B) value ($/kg) of the alewife catch, by province, 1960-1997.

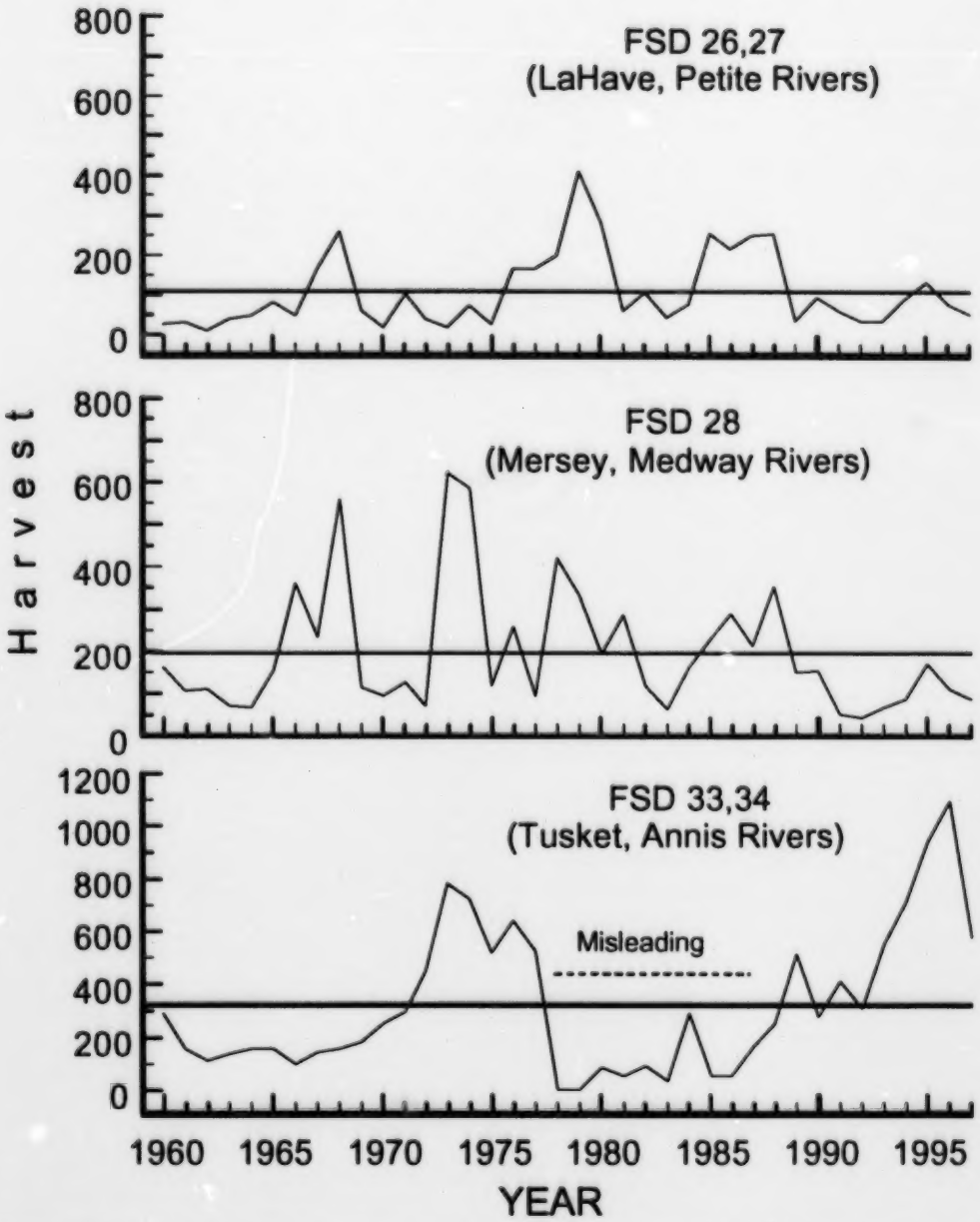

Figure 3. Alewife (and blueback herring) catches (t) in the LaHave-Petite, Medway-Mersey, and Tusket-Annis rivers, 1960-1997. In the Tusket-Annis rivers, the catch statistics for the years 1978-1988 are believed to be erroneously low (see text).

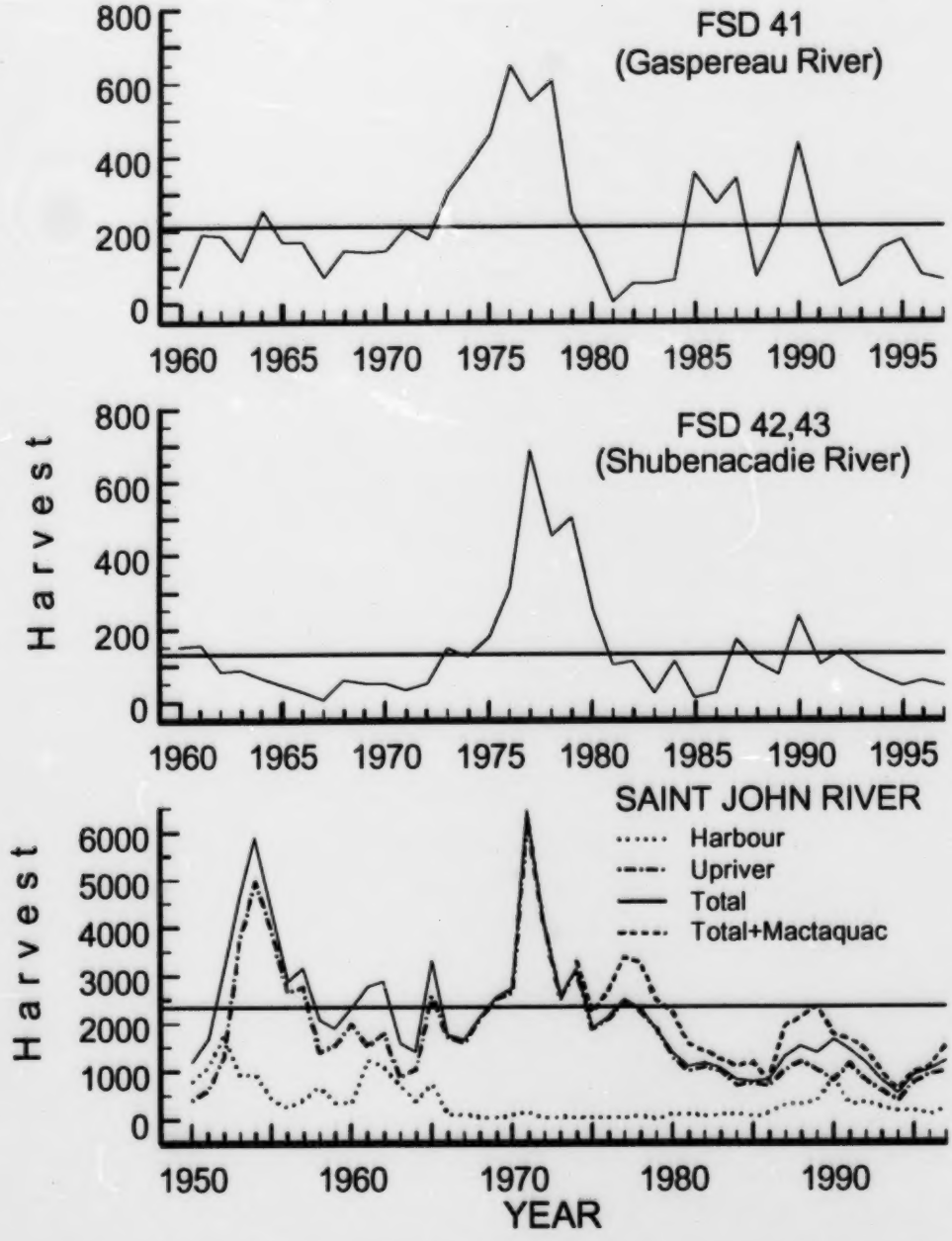

Figure 4. Alewife (and blueback herring) catches (t) in the Gaspereau, Shubenacadie rivers, 1960-1997, and Saint John River, grouped by fishery: harbour (FSD 48,49), upriver (FSD 55-57), and Mactaquac Dam, 1950-1997.

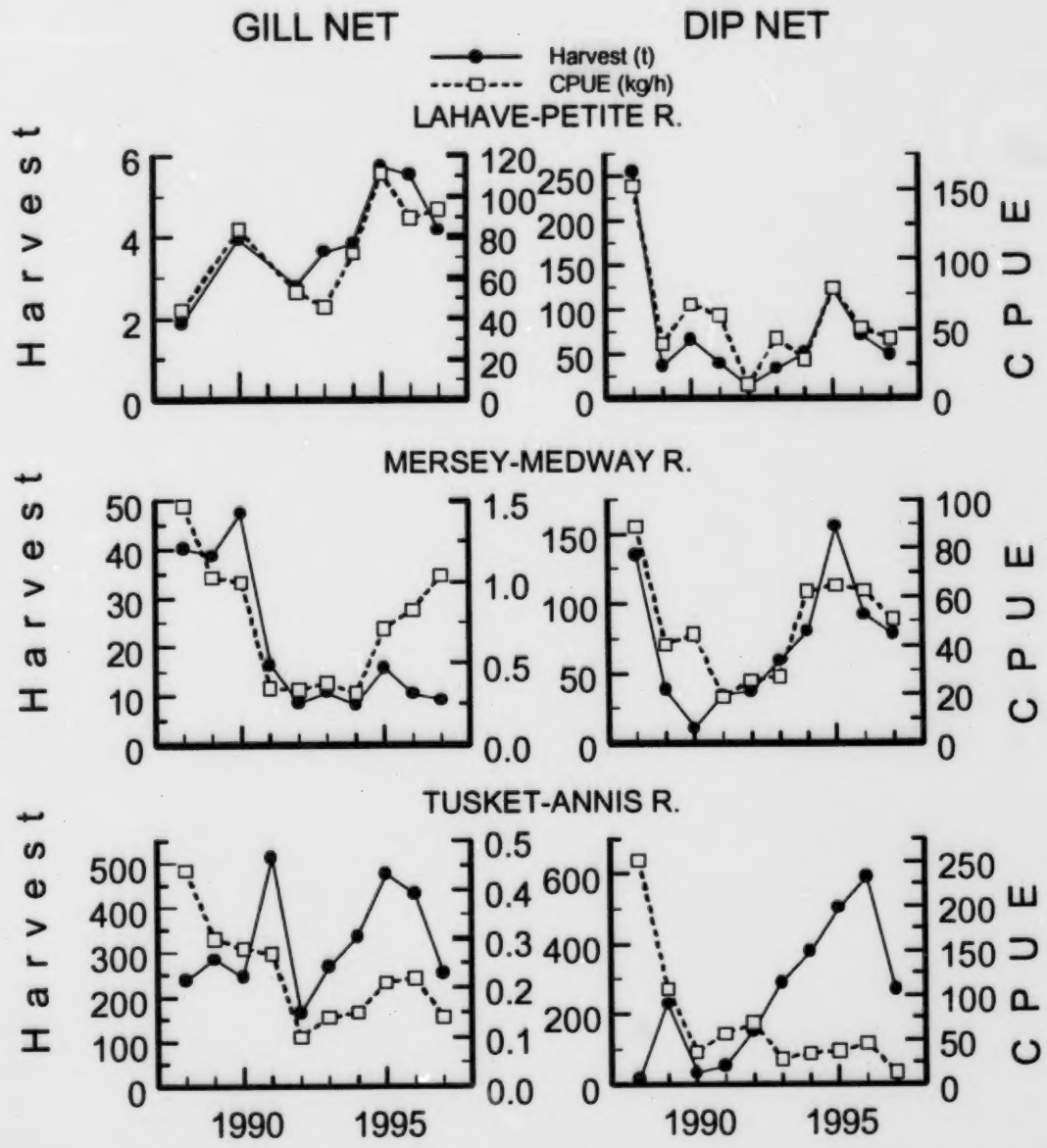

Figure 5. Alewife harvests and catch-per-unit-effort (CPUE) for gill and dip net fisheries in the LaHave-Petite, Mersey-Medway, and Tusket-Annis rivers, 1988-1997.

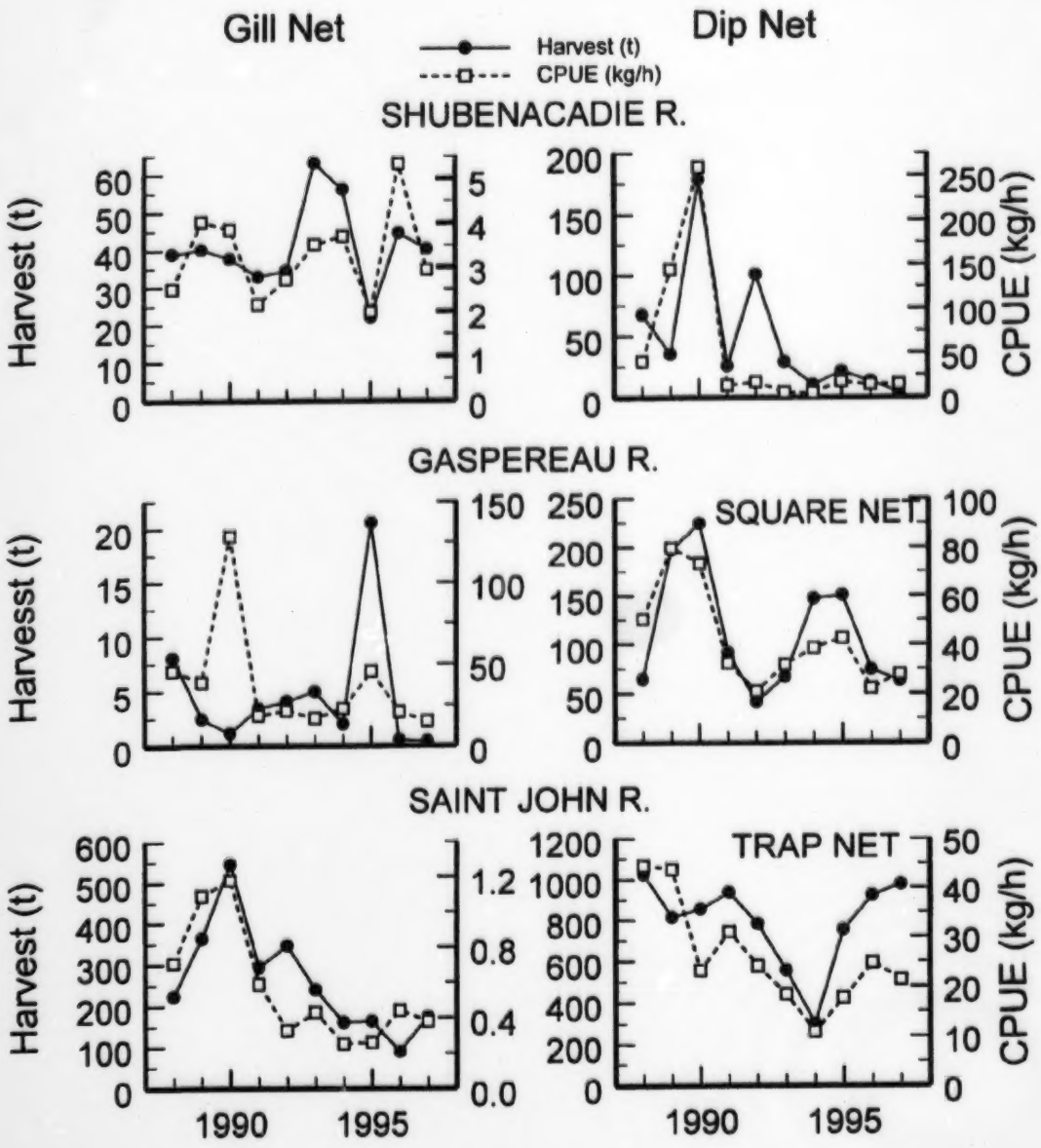

Figure 6. Alewife harvest and catch-per-unit-effort (CPUE) for gill and dip net fisheries in the Shubenacadie, Gaspereau, and Saint John rivers, 1988-1997